Willingness to Pay for Seafood Quality Improvement in the HACCP System: Evidence from Taiwan*

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This study investigates the perception of Taiwanese consumers about seafood safety in the Hazard Analysis Critical Control Point (HACCP) system implemented in the seafood industry. An econometric Logit model is applied to estimate relationships between perceptions of seafood safety and seafood consumption in Taiwan. Empirical results show that there are significant differences in perceptions between gender, education, income, eating location and buying behavior. On average, consumers are willing to pay more for certified seafood due to safety concerns and to save time. However, some seafood producers are concerned about increasing costs needed for the recording and documentation required to implement the HACCP system. The study further suggests that the guidance and assistance to the industry and the consumers' education provided by the government were important in the initial stage.

Keywords: Seafood Quality, HACCP System, Consumer Perception, Willingness to Pay

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I. Introduction

Quality and safety regarding seafood is becoming multi-dimensional and consumers have great difficulty in determining and observing actual seafood quality (Anderson and Anderson, 1991). Food security is a major global concern today. It is significant to both the public and the regulators as testified at the World Food Summit (WFS) in Rome 1996. Consumers are becoming increasingly concerned with the quality, safety and production attributes of their food (Caswell, 1997). Seafood, once considered pure and free of food adulterants, is currently facing more controversies and challenges in Taiwan. Seafood consumption is embedded in the Taiwanese culture and can be observed on the table of a typical Taiwanese family and in many cultural festivities. However, seafood-advertising activities that take part in the culture festivities encourage exposure to food adulterants. Thus, it is imperative to make seafood inspection and certification mandatory, as well as for companies involved in the international seafood trade to formally adopt the Hazard Analysis and Critical Control Point (HACCP) system. An announcement of the detailed rules and regulations was printed in the bulletin on December 23, 2004 published by the Taiwanese government.

Previous seafood research shows that one single acute regional contamination event can lead to a collapse in demand of other products from unaffected regions because of insufficient information dispensed to consumers. (Swartz and Strand, 1981; Wessells, Miller, and Brooks, 1995). Due to the uncertainty of seafood supply and its safety, more information should be provided to consumers. Safety is one of the many implicit characteristics of seafood that influences the purchasing behavior of the consumer at various prices and quantities. However, people often obtain vague information from media and rely on their own knowledge of seafood safety. Hence, the perception of seafood quality and safety from a consumer point of view and from

international trade concerns are becoming important. In fact, seafood inspection and certification were gradually set into action on the world, and it is clear that international legislation is moving toward making the HACCP system a mandatory requirement for the food industry.

Recent incidences of chemical residues in seafood in Taiwan were found in exported seafood products to the European Union and Japan. Not only are real risks associated with the consumption of selected seafood products but also the perceived risk from seafood consumption all have been discussed by the media's reports, which hinder the future exporting of seafood products overseas. Restoring confidence in seafood now presents a considerable commercial challenge to the seafood industry. Perception of seafood safety is one such psychological interpretation, which influences the attitudes and behavior of consumers with respect to the purchase of seafood products. This study focuses on the consumer's perception of the seafood HACCP system and their willingness to pay (WTP) for seafood safety and quality in Taiwan. The objectives of this paper are: (1) to explore the perception of Taiwanese consumers about seafood safety; (2) to analyze the impact of factors influencing the consumer's WTP for the seafood HACCP system; (3) to estimate Taiwanese consumer's mean WTP for the seafood HACCP system; and (4) to discriminate the info-selected preference induced by the seafood HACCP system from the consumers who have different socio-economic characteristics.

This paper is divided into seven sections. Section II discusses the status of the HACCP system in Taiwan. Section III states seafood safety issues and roles of government. Section IV presents the survey design and implementation. Section V establishes the econometric model. Section VI shows model specifications and results. Section VII summarizes the findings.

II. The Status of HACCP System in Taiwan

The HACCP system has been acknowledged as one of the most effective methods assuring product safety and is becoming internationally recognized as a tool for controlling food borne safety hazards. The HACCP system of Codex Alimentarius with its seven principles is used to: 1) hazard analysis; 2) determine Critical Control Points (CCP); 3) establish critical limits for each CCP; 4) establish procedures to monitor each CCP; 5) establish corrective actions; 6) establish record keeping; and 7) establish verification procedures. The HACCP system can be structured into three elements: hazard analysis (principle 1), measures for hazard control (principles 2-5), and verification and documentation of the system (principles 6-7). The seafood processing companies in Taiwan ought to fulfill these principles in order to conform the HACCP requirements. The Codex Alimentarius definition for hazard analysis is "The process of collecting and evaluating information on hazards and conditions leading to their presence to decide which are significant for food safety and therefore should be addressed in the HACCP plan".

During the last three decades, the HACCP system was introduced and applied by the food industry, however, it has not been homogeneously implemented across all food sectors. Reasons for not implementing, maintaining and updating HACCP programs cannot be explained only in terms of unwillingness by manufacturers but rather by the presence of technical barriers that impede the application of the system. It is worth mentioning that in modern food control systems, especially for raw foods, risk-based scientific evaluation of inspection programs now clearly identifies effective process control as by far the most important element in assuring food safety. The industry traditionally had the primary responsibility for good-manufacturing and product-based process control but now has primary responsibility for the HACCP-based control. The trigger for establishing a formalized and documented food safety

program across local food industry match those around the world; the community expects safe food, without compromise.

Taiwan (2002/1/1) has become a member of the World Trade Organization (WTO), thus for globalization and liberalization in trade to put a premium on the fishery industry, there is a pressing need to make seafood inspection and certification mandatory. In view of the Agreement on the Application of Sanitary and Phyto-sanitary Measures (SPS) that sets out the basic rules for food safety and animal and plant health standards, and food safety of the HACCP system, the outlook for Taiwan fisheries is that all seafood export and import must follow these standards. The trend for companies to adopt the integration of HACCP plans, such as those involved in 'farm-to-table' food production, is that risk-based safety goals will most likely increase. Taiwan recognizes the urgent need for a framework to judge the equivalence of HACCP-based food control systems for international seafood trade in different countries (see Figure 1).

While the HACCP system has been implemented in many food processing plants, there are concerns that incentives may be inadequate to stimulate the adoption of the HACCP system by certain types of businesses (such as. small and medium-sized enterprises) and in certain sectors (such as those with low operating margins). This is the case especially when the costs and benefits associated with the implementation and operation of the HACCP system in seafood processing sector suggested that the major cost of implementing and operating the HACCP system in seafood processing plants is staff time required to document the system. Record keeping was the cost most frequently incurred. The costs of capital investment and external technical expertise were found to be less important. In addition, there are also concerns that the costs of implementing the HACCP system in order to provide appropriate advice and/or assistance to food businesses. (Chang, 2001).

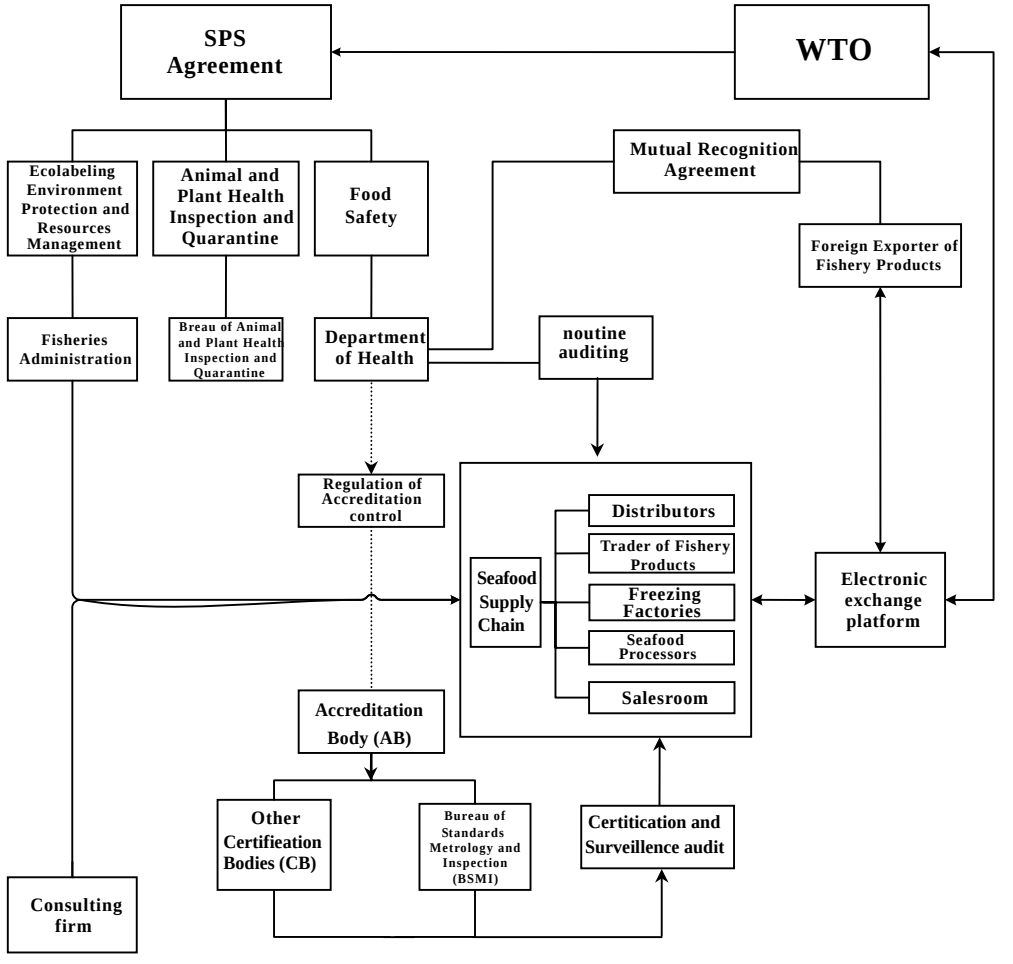

Figure 1.　Taiwan's Seafood Safety Control System after joining the WTO

Source: this study.

III. Seafood Safety Issues and Roles of Government

Seafood safety and quality affects the choices of consumers. The most important benefit of applying the HACCP system is to increase the capability of retaining existing

customers. Around 80% of the companies estimated that it had taken 12 months or less to implement the HACCP system. However, around 12% estimated that it had taken more than 18 months. Although there has been no similar research done in Taiwan, the results may have implications for the adoption of the HACCP system in the world the food industry as a whole (Chang, 2001). When food is treated as a heterogeneous good, it becomes a bundle of attributes, including price, taste, food quality, food safety, nutritional characteristics, and environmentally friendly production processes (Lancaster, 1966). According to Kramer and Twigg (1970) and Hanson and Traill (1993), authentic food safety and quality are different from the risk consciousness considerations consumers have when deciding on what food to consume. Research has shown that much of the public's reaction to risk can be attributed to sensitivity not only to the technical but also to the social and psychological qualities of hazards (Slovic, 1993). In general, the notions of food safety can be covered under the scope of food quality. Consumers' seafood buying behavior is the same as their meat and poultry buying behavior when affected by price, price of substitution, income, eating habits and preferences (Hanson, Herrmann and Dunn, 1995).

Since food safety is generally a hidden quality, it can easily be affected by the impressions or images of foods that consumers receive elsewhere. According to Johnson and Griffith (1996) and Kinnucan and Wessells (1997), consumers' behavior was correlated with food safety information acquired. Consumer's perception about food adulterants and food safety was unsystematic and incompatible (Johnson and Griffith, 1996). Nevertheless, labeling can be a way to solve the problems mentioned above. Consumers' cognitive about food adulterants increase the demand for certified seafood products indirectly. (Caswell, 1997; Kuo and Chuang, 2002).

Food safety is an investment that consumers demand. Thus, the government should ensure that all food processors establish a certain level of safety in what they market for the wellbeing of both the consumer and the food processing businesses. HACCP requirements are rapidly becoming an integral part of international trade in

food commodities and many governments have responded to this trend by repositioning their approaches to the HACCP system in the food export sector. Although food processors have not fully taken up the implementation of the HACCP system, the related legislations have been introduced in many countries. However, industries remain the primary players in the implementation of the HACCP system while structural changes within the regulatory environment have ensured that overall responsibilities remain with the "core government" while introducing flexibility in some aspects of delivery of HACCP programs. Trends emerging internationally have changed scientific, operational and political dynamics, particularly highlighting the value of validating HACCP plans according to food-safety objectives. Negotiation of equivalence between trading partners, of HACCP programs that are genuinely science- and risk-based, continues to be the governments' primary market access approach (Chang, 2001).

In reality, the seafood HACCP applied is constrained by the sanitation condition of each individual factory. Generally, the poorer the sanitation practices, the worse the HACCP will function. The hazard derives from the lack of sanitary control and has to be compensated and monitored by the CCP; this creates a load to the HACCP. Conditions like these cause individuals to have to obey Good Hygienic Practices (GHP), to improve the sanitation of the manufacturing environment and to fill in with minimum sanitation requirements. The cause-effect regarding safety risk and sanitation practices are shown in Figure 2. Here, individuals with poor sanitation practices have higher safety risks than individuals with good hygiene practices. It is crucial to note that there is a small safety risk distance from acceptable safety level in end items. Therefore, the HACCP management system has to be put on the stage first then try to eliminate existing hazards. In other words, the more adequate sanitation conditions exist, the more effective the HACCP management system will function.

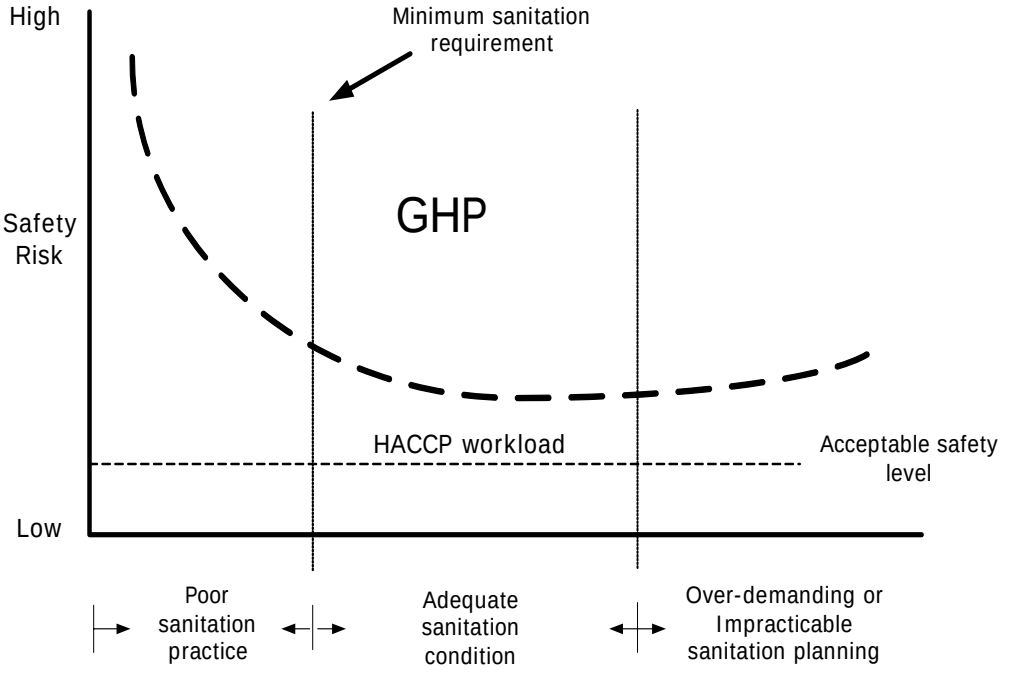

Figure 2. Safety risk and sanitation practice

Source: this study.

IV. Survey Design and Implementation

Based on the objectives of this study, the contents in the questionnaire related to seafood safety and the consumer's willingness to pay for seafood quality are divided into three parts: (1) characteristics of seafood consumption and preferences that are likely to influence the seafood purchase decisions of households; (2) consumer's perception and valuation of the seafood HACCP system, and (3) socio-economic and demographic characteristics of the representative respondent. The essential part in this questionnaire is to detect consumers' choices that could reveal the consumer's preference. The data was gathered through a mail survey conducted over a month in January 2004. Purposive sampling was conducted in this study. Individuals were

selected from volunteers and members of the Taiwan Fisheries Development Association based on their specific insights into the management of the ocean. This survey was best suited to be a subjective-qualitative measurement where the researchers were interested in the perspectives and experiences of particular groups and individuals.

A total of 347 out of 823 respondents returned the questionnaire, of these, 331 provided effective responses. The mean for WTP was computed for each independent variable; the results are shown in Table 1. This table indicates that the male consumer's mean WTP was higher than that of the female consumer. This implies that the male consumers cannot easily acquire market information as female who tend to bear a large share of the responsibility for household affairs. The traditional impression of women is that they must maintain careful expense calculations and maintain strict budgeting. The effect of the buyer's explanatory variable is similar to the effect of the gender variable, whereas the consumer is not familiar with fluctuations in the market is willing to pay more than those who are. Furthermore, the variables like education and family average income have a positive effect and significantly differ from the perceptions regarding characteristics of gender, education, income, eating and buying locations.

Table 1. Mean WTP Summary by Independent Variable

Variable Name	Description	Mean WTP(% of the current price)
Gender*	Female	7.3460
	Male	8.3019
Buyer*	Main buyer in household	6.7255
	Not main buyer in household	8.8079
Education	Junior High diploma and below	4.2534
	Senior High and vocational diploma	5.9368
	Junior College and above	8.6168
Children	Children under 15 year old in household	8.5269
	No children under 15 year old in household	6.9535

Table 1. Mean WTP Summary by Independent Variable (continue)

Variable Name	Description	Mean WTP(% of the current price)
Senior	Senior above 65 year old in household	7.9035
	No senior above 65 year old in household	7.7311
Occupation*	Agriculture, forest, fishery and husbandry	8.9660
	Industry, business or service industry	7.1282
	Military, public or teaching	9.6763
	Freeman	5.8068
	Professional	7.4192
	Student	4.5645
	Otherwise	8.1267
Family Size	Household members ≤4	8.1100
	Household members >4	8.1900
Income*	NT $39,999 and under	5.7244
	NT $40,000 to NT$ 79,999	7.7253
	NT$ 80,000 and above	9.5338
Area*	North Taiwan	8.6135
	Middle Taiwan	5.7554
	South Taiwan	8.6863
	Eastern Taiwan	5.8987
	Off-shore island	5.6916
Eating frequency	0-2 times a week	7.2959
	3-5 times a week	8.1952
	More than 6 times	8.2538
Eating place*	Home	7.8897
	Snack bar	6.5232
	Restaurant	9.8445
Buying place	Traditional market	7.8804
	Supermarket	7.3010
	Fishery market	7.4266

Note: * Significant from ANOVA test

Source: this study.

V. Econometric Model

An econometric model based on the utility paradigm is used to reveal a person's preference and the satisfaction he/she receives from their activities. Utility maximization is the guiding notion underlying consumer choices analyzed with the consumer demand theory and utility analysis (Spinks and Bose, 2002). It is logical to consider that people are generally motivated to do what is best for them, to purchase the most satisfying goods, to make the decisions that do more good than harm, and to improve their overall living standards and well-being. Therefore, using the concept of consumer preference, the economic model structure can be put as:

Seafood HACCP support=f(Attributes of seafood, Perception of consumer, Demographic characteristics)

Based on the utility principle, the regression model can be expressed as:

$$Y_i^* = \alpha + \sum_{j=1}^{k} \beta_j X_{ij} + \varepsilon_i \quad (1)$$

where Yi^* is an unobservable dependent variable that represents a respondent's willingness to pay more money for certified seafood product, and the variable X_{ij} represents the different attributes affecting the household's choice to purchase certified seafood. X_{ij} consists of variables such as gender, main buyer, high price accepter, senior and children in household, education, occupation, average monthly income etc. The Logit model for calculating the probability of Y_i=1 can be expressed as follows:

$$P_i = F\left(\alpha + \sum_{j=1}^{k} \beta X_i\right) = \left(\frac{Exp\,(I_i)}{1 + Exp\,(I_i)}\right) \quad (2)$$

where $I_i = F\left(\alpha + \sum_{j=1}^{k} \beta X_i\right)$ is called the index function.

To calculate the probability of Y_i=1 the Logit model can be expressed as:

$$(1-P_i)=\left(\frac{1}{1+Exp\,(I_i)}\right) \tag{3}$$

The parameters α and β of the Logit model was estimated by maximum likelihood estimation (MLE), then, the likelihood function has the form

$$\begin{aligned} L &= \Pr ob(Y_1=y_1, Y_2=y_2 .....Y_n=y_n) \\ &= \prod_{y_i=1}\left(\frac{Exp(I_i)}{1+Exp(I_i)}\right)\prod_{y_i=0}\left(\frac{1}{1+Exp(I_i)}\right) \end{aligned} \tag{4}$$

Log-likelihood function can be derived as

$$\log L=\sum_{i=1}^{n_i}\log\left(\frac{Exp(I_i)}{1+Exp(I_i)}\right)+\sum_{i=n_1+1}^{N}\log\left(\frac{1}{1+Exp(I_i)}\right) \tag{5}$$

To obtain the slope estimators $\hat{\alpha}\ and\ \hat{\beta}$, we differentiate *log L* with respect to α and β, then set the results equal to zero.

$$\frac{\partial(\log L)}{\partial\alpha}=0$$
$$\frac{\partial(\log L)}{\partial\beta}=0$$

We can obtain the vectors of $\hat{\alpha}\ and\ \hat{\beta}$, which are the maximum likelihood estimators. The candidates for independent variables in the model are described in Table 2. The most obvious characteristics of the explanatory variables in this study are that they are all binary variables. According to the statistical estimation process established in the previous section, the factors that affect consumers' choice of seafood HACCP support were analyzed in SPSS and SHAZAM statistical programs.

Table 2. Definition of independent variables

Independent Variable	Description		Mean
	1	0	
GEN	If female	If male	0.5106
SHS	If Seafood HACCP supporter	Otherwise	0.9396
HPA	If higher price accepter	Otherwise	0.8248
MBH	If main buyer in household	Otherwise	0.4773
CHI	If under 15 year old children in household	Otherwise	0.5770
SEN	If above 65 year old senior in household	Otherwise	0.4804
GED	If Junior High education level and below	Otherwise	0.0544
MED	If Senior High and vocational education level	Otherwise	0.2326
HED	If Junior College education level and above	Otherwise	0.7221
GAI	If household monthly average income in scope of 0 to NT 39999	Otherwise	0.2779
MAI	If household monthly average income in scope of NT 40000 to NT 79999	Otherwise	0.3656
HAI	If average income monthly in household at range NT 80000 and above	Otherwise	0.3565
NTW	If respondent live in North Taiwan	Otherwise	0.4109
MTW	If respondent live in Middle Taiwan	Otherwise	0.1631
STW	If respondent live in South Taiwan	Otherwise	0.2991
ETW	If respondent live in Eastern Taiwan	Otherwise	0.0755
OST	If respondent live in Off-shore island	Otherwise	0.0514
OCA	If respondent is employed as agriculture, forest, fishery or husbandry	Otherwise	0.2145
OCI	If respondent is employed as industry, business or service industry	Otherwise	0.2628
OCM	If respondent is employed as military, public or teaching	Otherwise	0.2477
OCF	If respondent is employed as a freeman	Otherwise	0.1118
OCP	If respondent is employed as a professional	Otherwise	0.0302
OCS	If respondent is employed as a student	Otherwise	0.0937
EPH	If respondent consider home for first seafood eating place	Otherwise	0.7372
EPR	If respondent consider restaurant for first seafood eating place	Otherwise	0.0967
CAC	If the most care of catch timing when seafood buying	Otherwise	0.0997
CAQ	If the most care of quality when seafood buying	Otherwise	0.6405
BPT	If respondent prefer traditional market when seafood buying	Otherwise	0.5982
BPF	If respondent prefer fishery market when seafood buying	Otherwise	0.1329
BPS	If respondent prefer super market when seafood buying	Otherwise	0.1178
EFV	If respondent eating seafood more than six times a week	Otherwise	0.2810
BFV	If respondent buying seafood more than six times a week	Otherwise	0.0846

Source: this study.

VI. Model Specification and Results

Hypothesis tests were used to determine the combination of explanatory variables that determine the dependent variable with the highest likelihood. The results showed that "GEN", "MBH" and "EPH" have statistically significant t-ratios under several different combinations of explanatory variables. They explain the fact that consumers' info-selected preferences were different from the characteristic of a consumer that fits the expectations of this study. In order to obtain further results to get useful information, the model was improved by changing the dependant variable from "choice of certified seafood" where all attributes are explanatory variables to "Yes for seafood HACCP support." The meaning behind this change is slightly different because the choice of certified seafood assumes that consumers who are interested in certified products could have more concerns about health risk but may not support seafood HACCP, which results from the food safety issue. Following this assumption, by observing consumers' characteristics, we can demonstrate that consumers' perceptions about food safety have impacts on their seafood consumption choices.

The theoretical framework is illustrated in the formula below:

Seafood HACCP support = f (Attributes of Good, Perception of Consumers, Demographic characteristics)

y* = 1 if consumer support seafood HACCP

y* = 0 if consumers did not support seafood HACCP

Each single independent variable is replaced by "multiple independent variables" which represent interactive terms by multiplying variables by pair. The meaning of this procedure is to impose and intensify the explanatory abilities of variables. The model is improved as:

$$Y^* = \beta_i X_i' + B_j V_j + e$$

$$V_j = \sum_i \sum_j X_i X_j$$

Where Y* = consumers support seafood HACCP, X_i= the main effect, and X_j = perception and demographic variables. V_i=the interactive terms. The interactive explanatory variables are shown in Table 3. For goodness-of-fit of the model, predictive abilities of variables were tested by hypothesizing:

$$H_0 : \beta_2 = \beta_3 = ... = \beta_{34} = 0$$

H_a: at least one parameter not equal to zero

To calculate the likelihood ratio test: -2(lnLr - lnLu) ~ X^2_{df}, we have 255.834 > $X^2_{34,\ 0.95}$ = 22.465. It can be said that this model effectively explains the factors that affect the support for the seafood HACCP system.

Table 3. Combination of interactive explanatory variables

Code	Interactive term	Description
I-11	GEN*GAI	Interaction of female consumer and who with lower level average income
I-12	GEN*HAI	Interaction of female consumer and who with higher level average income
I-13	GEN*HED	Interaction of female consumer and who with higher education level
I-14	GEN*GED	Interaction of female consumer and who with general education level
I-15	GEN*NTW	Interaction of female consumer and who live in north Taiwan
I-16	GEN*STW	Interaction of female consumer and who live in south Taiwan
I-17	GEN*BPT	Interaction of female consumer and who prefer buying seafood in traditional market
I-18	GEN*BPS	Interaction of female consumer and who prefer buying seafood in supermarket
I-19	GEN*OCI	Interaction of female consumer and who employed as Industry, business or service industry
I-10	GEN*OCM	Interaction of female consumer and employed as Military, public or teaching
I-21	MBH* GAI	Interaction of main buyer in household and who with lower level average income
I-22	MBH* HAI	Interaction of main buyer in household and who with higher level average income
I-23	MBH* HED	Interaction of main buyer in household and who with higher education level

Table 3. Combination of interactive explanatory variables (continue)

Code	Interactive term	Description
I-24	MBH* GED	Interaction of main buyer in household and who with lower education level
I-25	MBH* NTW	Interaction of main buyer in household and who live in north Taiwan
I-26	MBH* STW	Interaction of main buyer in household and who live in south Taiwan
I-27	MBH* BPT	Interaction of main buyer in household and who prefer buying seafood in traditional market
I-28	MBH* BPS	Interaction of main buyer in household and who prefer buying seafood in supermarket
I-29	MBH* OCI	Interaction of main buyer in household and who employed as Industry, business or service industry
I-20	MBH* OCM	Interaction of main buyer in household employed as Military, public or teaching
I-41	EPH* GAI	Interaction of prefer seafood eating at home and lower average income
I-42	EPH* HAI	Interaction of prefer seafood eating at home and higher average income
I-43	EPH* HED	Interaction of prefer seafood eating at home and higher educational level
I-44	EPH* GED	Interaction of prefer seafood eating at home and lower educational level
I-45	EPH* NTW	Interaction of prefer seafood eating at home and live in north Taiwan
I-46	EPH* STW	Interaction of prefer seafood eating at home and live in south Taiwan
I-47	EPH* BPT	Interaction of prefer seafood eating at home and prefer seafood buying in traditional market
I-48	EPH* BPS	Interaction of prefer seafood eating at home and prefer seafood buying in supermarket
I-49	EPH* OCI	Interaction of prefer seafood eating at home and employed as Industry, business or service industry
I-40	EPH* OCM	Interaction of prefer seafood eating at home and employed as Military, public or teaching
I-51	EPH*EFV	Interaction of consumer prefer seafood eating at home and who eat seafood very often
I-52	EPH*CHI	Interaction of consumer prefer seafood eating at home and who have under 15 year old children in household
I-53	EPH*CAQ	Interaction of consumer prefer seafood eating at home and who with most quality concern
I-54	EPH*SEN	Interaction of prefer seafood eating at home and have above 65 year old senior in household
I-55	BFV*CAQ	Interaction of consumer buying seafood very often and who with most seafood quality concern

Source: this study

The results of the regression estimation are presented in Table 4. In the interaction effect parts, interactive terms that affected consumers' support for the seafood HACCP system were analyzed. The estimation results are the following:

Table 4. Estimation results

	Logit model		
Code	Estimated coefficient	Standard error	t-ratio
I-11	0.162	0.053	2.983**
I-12	0.009	0.055	0.172
I-13	-0.108	0.054	-1.976
I-14	0.026	0.055	0.464
I-15	0.019	0.055	0.348
I-16	-0.034	0.055	-0.610
I-17	0.060	0.055	1.099
I-18	-0.111	0.053	-2.203*
I-19	0.173	0.053	3.181**
I-10	-0.222	0.052	-4.132**
I-21	-0.026	0.055	-0.469
I-22	0.021	0.055	0.383
I-23	-0.042	0.055	-0.756
I-24	0.040	0.055	0.719
I-25	-0.024	0.055	-0.428
I-26	0.049	0.055	0.898
I-27	0.031	0.055	0.557
I-28	0.026	0.055	0.471
I-29	0.020	0.055	0.367
I-20	0.040	0.055	0.727
I-41	-0.074	0.057	-1.343
I-42	0.015	0.055	0.264
I-43	-0.141	0.049	-2.577*
I-44	0.023	0.051	0.421
I-45	0.038	0.054	0.695
I-46	0.015	0.055	0.278
I-47	0.155	0.056	2.838**
I-48	-0.059	0.058	-1.063
I-49	-0.018	0.056	-0.320
I-40	-0.007	0.055	-0.129
I-51	0.204	0.044	3.779**
I-52	0.187	0.054	3.456**
I-53	0.110	0.056	2.016*
I-54	0.121	0.054	2.207*
I-55	-0.142	0.057	-2.600**

Note: * and ** represents 1% and 5% significant level respectively.
Source: this study.

For variable "GEN*GAI" respondents were females with lower level average income and would more likely support the seafood HACCP system. For variable "GEN*BPS", the respondents were female consumers who preferred buying seafood at the supermarket and would not support the seafood HACCP system. "GEN*OCI" and "GEN*OCM" represent female consumers who were employed in industries, businesses or service industry, employed as teachers, served in the military or public service. These two outcomes imply that consumers' can have different support for the seafood HACCP system depending on their occupation. Respondents who prefer eating seafood at home and who prefer buying seafood from the traditional market (EPH*BPT) responded that they would support the seafood HACCP system as well as the "EPH*EFV that represents consumers who prefer eating seafood at home very often. Moreover, respondents who have children (EPH*CHI) and seniors (EPH*SEN) in a household would pay more attention about seafood safety. Consumers who prefer eating seafood at home and who have the most seafood quality concerns (EPH*CAQ) responded that they would have very strong interests in buying seafood with the HACCP certification. By contrast, consumers who buy seafood very often and with most seafood quality concerns (BFV*CAQ) responded that they would strongly dislike supporting seafood with the HACCP certification.

This section discusses the variables that did not affect consumers' support for the seafood HACCP system. In this model, the main buyer in a household (MBH) is significant but the interactive term does not show a crucial role in consumer's decision for seafood buying. In other words, the main buyer dictates the household expenditure but is not affected by the other consumers' characteristics. Consumer's living experiences, eating habits and individual beliefs about seafood safety can explain such differences.

VII. Conclusion

In this paper, factors that induce consumers' willingness to pay for the seafood HACCP certification and the status of the HACCP implementation are considered. The results show that there are significant differences in perceptions regarding the characteristics of gender, education, income, eating and buying locations. It also implies that the guidance and assistance provided by the government are important in the initial stages. The most important benefit of applying the HACCP system is to obtain the capability to retain existing customers. It also indicates that consumers would like to pay more (on average, 7.81% of the current price) for certified seafood due to safety concerns and to save time. However, some producers are concerned that prices will increase when the HACCP system is implemented. The HACCP system that works in practice will depend on the competency of many factors: the people who develop and operate it, the prerequisite programs that support it, the auditing and verification procedures that assess it and the legislation that supports it. Food exporting countries are now inextricably bound to a comprehensive HACCP-based food control system to ensure the safety of food in international trade and to obey the market access requirements of importing countries. Food safety is an "investment of food risk" that has to conform to the government's requirements and consumers' demand, which can push a company to produce safe foods. In fact, it is the primary responsibility of the industry to develop, implement and maintain HACCP systems. Furthermore, the government's authority efforts to improve the knowledge that relates to emerging hazards will improve the capability of the HACCP plan to meet specific public health goals that are important for implementing the plan.

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水產品導入 HACCP 改善品質消費者願付價格分析*

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本文探討台灣消費者對於水產業實施水產品危害分析與重要管制點（HACCP）管理制度的認知。本研究利用羅吉特計量模型(Logit model)分析消費者對於水產品安全衛生認知及其選擇消費水產品的關係。實證研究結果顯示，國人對於水產品實施 HACCP 管理的認知受性別、教育、所得、消費地點及購買行爲等不同消費者特徵的影響。整體而言，消費者基於安全衛生感與節省時間的考量，普遍願意支付較高價格來選購經認證的水產品，不過部份業者則擔心因執行 HACCP 管理所產生登錄考評上的成本上升，因而對此管理制度的實施有所保留。最後，本文建議在政策實施的初期，政府有必要提供產業界相對的協助與輔導，另外加強消費者對食品衛生安全教育亦是重要的工作。

關鍵字：水產品品質、HACCP 管理制度、消費者認知、願付價格

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